

Hierarchy of thinking skills

Perhaps the ability to think is what distinguishes humans from all other forms of animal life. There are different levels of thinking. The IB places thinking skills in order of increasing complexity.

The first three which involve knowledge acquisition, comprehension and application are known as lower-level thinking skills whereas the ability to analyse, evaluate and create are known as higher level thinking skills.



The key assessment [objectives](#) of IB Diploma Chemistry relate directly to these thinking skills. The three objectives used for external assessment (the fourth covers practical skills) in plain English are:

1. State a definition or fact
2. Apply this knowledge in a straightforward situation
3. Analyse, evaluate and determine how to solve a problem by selecting the relevant information or method.

Relationship between thinking skills and IB assessment objectives

Thinking skill	Objective 1	Objective 2	Objective 3
1. Remember	X		
2. Understand	X		
3. Apply		X	
4. Analyse			X
5. Evaluate			X
6. Create			X

It is important to be able to distinguish between the three objectives because Objective 3 cannot be implemented without the knowledge and understanding gained through Objectives 1 and 2. The external examinations recognise this and the questions are set so that approximately 50% of the papers tests Objectives 1 and 2 and 50% tests Objective 3. This means that your thinking and learning need to be structured to fit this.

The way that the chemistry course is set out into main topics and sub-topics and with the information and concepts listed under 'understandings' and 'applications and skills' all under "Learning outcomes" for each sub-topic on this site makes it relatively easy to follow these thinking skills logically. For example, it can be illustrated by looking at the progression in thinking required and some of the processes that have to be gone through for you to design and implement an experiment to determine whether the shell of eggs from free range chickens contains a higher percentage of calcium carbonate than from battery-reared chickens.

Progress of thinking skills required

Know the concept of an acid and a base

Remember different definitions

Define quantities

Remember amount, volume, concentration etc.

Define units

Remember mol, cm³, mol dm⁻³, pH etc.

Show how titration works

Understand the stoichiometric relationship between amounts and concentrations to reach the end point

Solve titration problems

Apply knowledge

Determine which indicator should be used for a specific titration

Analyse a novel situation

Perform an experiment to determine the amount of aspirin in an analgesic tablet

Evaluate the method used and the result(s) obtained

Plan an investigation to determine whether the shell of eggs from free range chickens contains a higher percentage of calcium carbonate than from battery-reared chickens

Create an experiment to solve an unknown problem, evaluate the results and put them into context.

What teachers will be trying to do during your course is to build up your ability to utilise higher level thinking skills. During your lessons you will need to be able to recognise whether the questions you are asked require a lower level or higher level of thinking skills to be answered ([command terms](#) can be helpful here). You should be allowed the appropriate time to think through your answers and, at times, be encouraged to work as part of a team rather than always working on your own to solve problems. This site contains a wide variety of questions you can use to further your understanding as well as test your knowledge. In general the multiple choice quiz questions perhaps require more lower level thinking skills to be answered whereas many of the short answer questions tend to be focused more on higher level thinking skills.
